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Socioeconomic inequalities in bodily pain over the lifecycle: Longitudinal evidence from Australia, Britain and Germany

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Abstract
We document the extent of socioeconomic (SES) inequalities in bodily pain in Australia, Britain and Germany, with a particular focus on whether such inequalities widen over the life course. Random effects logistic and kernel regressions are used to estimate odds ratios of experiencing severe pain by income, educational qualification and occupational status, and to graph age-pain profiles, while accounting for individual heterogeneity. Cohort level regression analysis is used to control for cohort effects. Low SES is consistently related to higher levels of bodily pain in each country and inequalities widen with increasing age. The odds of experiencing severe bodily pain for individuals in the lowest, relative to the highest, household income quartile is up to 2 times higher, while the odds for those with minimum relative to university education being up to 3 times higher. For each country, the odds of experiencing severe pain by machine operators are around 3 times higher than for professionals. Maximum levels, and maximum SES differences in pain, are both reached at around age 60, with the differentials ranging between 0.2 and 0.7 of sample standard deviations. No convergence of pain profiles is observed by age 70. Controlling for cohort effects in the Australian data confirms the results from the age-group analysis. Taken together these results suggest that low SES and manual work have cumulative health effects over the lifecycle.

Keywords: Socioeconomic status, bodily pain, lifecycle analysis, longitudinal data

JEL codes: I14

1. Introduction

The experience of chronic pain is a wide-spread phenomena and its experience is costly to individuals and society (Phillips and Harper, 2011; Kowal et al., 2012). Similar to other measures of health, strong socioeconomic (SES) inequalities in pain have been reported (Eriksen et al., 2003, 2006; Sjøgren et al., 2009; Andersson et al., 1993; Day and Thorn, 2010; Mottram et al., 2008; Saastomoinen et al., 2005; Lahelma et al., 2005), and the experience of pain varies by age (Dunn et al., 2011; Krueger and Stone, 2008; Saastomoinen et al., 2005; Eriksen et al., 2003; Ahacic and Kåreholt; 2012). In this paper we expand upon the previous literature by exploring the lifecycle variation in the SES gradients of pain. We use data on self-reported bodily pain from three large nationally-representative, longitudinal studies (Australia, Britain and Germany) and consider three measures of SES. To estimate the odds of experiencing high levels of pain by the risk factors of income, education, and occupation, we use random effects logistic regression models. To estimate the lifecycle profiles of pain, we use kernel regression to graph age-profiles for average pain levels by SES, conditional on observable characteristics and individual-specific variations in the self-report of pain, and a cohort level regression analysis used in van Kippersluis et al. (2009) and Deaton and Paxson (1998) to separate cohort from lifecycle effects.

No studies exist that examine whether the socioeconomic gradient in pain changes over the lifecycle. Some studies explored the evolution of the socioeconomic gradient in health over the lifecycle, but the literature is divided over whether the gradient in health widens or narrows (see van Kippersluis et al., 2009, for a detailed discussion).

Understanding which sub-groups in the population are most affected by increasing levels of pain over the lifecycle is an important task for shedding additional light on the origins of the socioeconomic gradient in health as described in e.g. Case et al. (2002), Smith (2007) and van Kippersluis et al. (2009). Understanding SES lifecycle dynamics in pain is also important for informing on the possible health consequences of the ongoing debate and movement towards increasing the minimum retirement age in many countries. It would enable policy-makers to gain an idea of which occupational groups will carry a disproportionate (health) burden if the compulsory retirement age is lifted, or were lifted even further as has been the case in many European countries. Moreover, knowledge of the lifecycle patterns of pain enables to better predict which groups of society are likely to incur heavy medical costs for treating chronic pain, or potentially claim disability benefits (see Saastamoinen et al., 2012).

One major challenge of our study is to distinguish cohort effects from true heterogeneity in ageing. It is possible that differences in the SES gradient in bodily pain observed over age-groups are not the result of heterogeneity in aging, but rather stem from differences in the gradient across cohorts. Observing differences in the evolution of pain across occupations over the lifecycle may be due to differential exposure to health hazards within the same occupation over time. Common hazards within manual occupations are for instance exposure to chemical substances, physical accidents, or physical strains (light, noise). Occupational health and safety regulations were not common until 1974 in Britain (Health and Safety at Work Act), until 1973 in Germany (Occupational Health and Safety Act), and until 1991 in Australia (Occupational Health and Safety Act). Another explanation for observing age-differences in the socioeconomic gradient in pain could be that low SES groups born during or just after World War II were more severely affected by early-life health hazards such as malnutrition or lack of access to basic medical services than low SES groups born in later years. It may well be the case that the socioeconomic gradient in pain for older generations was already present at young ages, and remained constant over the life course.

To separate out age from cohort effects, we complement our analysis by applying a cohort level regression analysis used in van Kippersluis et al. (2009) and Deaton and Paxson (1998) to construct lifecycle patterns of pain by cohorts. Both studies used longitudinal data with eight (ECHP) and nine years (PSID) of length respectively to construct age-profiles by cohort members. For instance, Deaton and Paxson (1998) construct for each birth cohort a dummy variable, and then graph for this birth cohort the health path and the variation in health over the nine years. The individual health paths of all cohorts combined give then a lifecycle pattern of health. The same approach is used in van Kippersluis et al. (2009), with the only exception that cohorts are formed within five-year intervals. We conduct this analysis with our Australian dataset (HILDA) only, for which we have 11 years of data on pain available. Last, we choose to demonstrate the evolution of the socioeconomic gradient in pain for three different measures of socioeconomic status, because of the alternative pathways via which income, education, and occupation status affect level pain (see Adler and Newman, 2002, for an overview of these hypotheses in the context of health status).

2. Literature Review

Pain is a common experience even as early as adolescence (see King et al., 2011; Dunn et al., 2011). It is estimated that over 48 million Americans experience chronic pain every year

(Day and Thorn, 2010). A study of 46,000 Europeans in 16 countries conducted in 2002/3 found that one-third of chronic pain sufferers experienced pain all of the time, and about 20% of those reporting chronic pain were diagnosed with depression as a result of their pain (Breivik et al., 2006). The economic consequences due to associated health care expenditures and the lost productivity from chronic pain are considerable (Stewart et al., 2003; Kapteyn et al., 2008; Day and Thorn, 2010; Phillips and Harper, 201; Krueger and Stone, 2008; Access Economics, 2007; Maniadakis and Gray, 2000).

Importantly, a variety of studies have identified significant SES inequalities in pain. Some provide population-based analysis, for example, using data from the Danish Health Survey (Eriksen et al., 2003, 2006; Sjøgren et al., 2009), while others focus on particular regions within a country and often target older populations. For example, Mottram et al. (2008) analysed data from the Staffordshire Survey (Britain) that interviewed 18,497 adults older than 50 years, while Saastomoinen et al. (2005) and Lahelma et al. (2005) examined pain differentials in 6,243 adults aged 40 and over residing in metropolitan Helsinki. Other examples of specific small sample studies are Andersson et al. (1993) who focused on a sample of 1,800 adults from two Swedish primary health care districts, and Day and Thorn (2010) who used a sample of 115 individuals in rural Alabama. Such specific small sample studies are relatively common in the medical literature on pain differentials (e.g. Dunn et al., 2011; Kowal et al., 2012). From the current literature we know that individuals with minimal education, with low incomes, and those working in manual occupations, are most likely to report chronic pain.

There are various pathways via which income, education, and occupation status affect level pain (see Adler and Newman, 2002, for an overview of these hypotheses in the context of health status). On the one hand, in countries with restricted access to high quality health care, high-income individuals are more likely to afford health care and rehabilitation services, and are more likely to reduce workload when suffering from chronic or acute pain. If money can buy short-run health improvements, one mechanism is likely to operate through relief from pain through medication and pain management therapies that are not, or only partially, covered by public health insurance. Also, money can buy higher quality of care and may grant immediate access to health care services that would have otherwise required a long waiting time. On the other hand, individuals working in low-skilled occupations and/or living in poverty are more likely to live amidst health risks. Low SES has been linked with more risky health behaviours such as alcoholism, smoking, and obesity, but also with exposure to environmental risk factors such as low-quality housing and pollution. Risky health behaviours may be due to differences in education, better-educated individuals make more informed lifestyle choices, or due to the psychological stresses of living in poverty. Yet, income or education differences alone may not be the reason why low SES is linked to pain. Occupational groups, which in themselves are the result of past educational choices, differ in their propensities to experience work-related injuries, and therefore in their propensities to suffer from chronic or acute pain.

A handful of studies reported how levels of pain vary by age-groups (Dunn et al., 2011; Krueger and Stone, 2008; Saastomoinen et al., 2005; Eriksen et al., 2003; Ahacic and Kåreholt; 2012), but no study exists that examine whether the socioeconomic gradient changes over the lifecycle. There are various paths that the SES gradient in pain can take over the life course (see van Kippersluis et al., 2009, for a detailed overview regarding general health status).

On the one hand, the SES gradient may increase over time following a process of accumulating effects of economic disadvantage. In such a view, early life disparities in health become magnified over the lifecycle (e.g. Ross and Wu, 1996; Lynch, 2003; Wilson et al., 2007; Kim and Durden, 2007). One mechanism by which this can occur is through the higher exposure of individuals with low income, and those in manual occupations, to work-related accidents and injuries. For example, heavy physical manual work such as heavy lifting, and long hours standing, impact on the spine and joints, and may cause two of the most common causes of pain, namely, back-pain and arthritis. A clear hypothesis is that such cumulative exposure will peak just before retirement, when the pain differential by occupations will be largest. In terms of general health status there is evidence that SES differentials peaks around retirement age in the US (e.g. Elo and Preston, 1996; Smith and Kington, 1997; Deaton and Paxson, 1998; Smith, 2005). In contrast, an inverse U-shape in the SES gradient of health has been found for some European studies (e.g. van Ourti, 2003; Kamrul et al., 2007). Other studies have found that the gradient diverges even further after retirement. Gerdtham and Johannesson, (2000) and Burström et al. (2005) show that the health gradient remains high, but stable, after reaching retirement age, while Chandola et al. (2007) report a further increase in the gradient.

Alternatively, SES differentials in pain might level off over the life course. Health problems will arise ultimately for all individuals over the ageing process. Such a view assumes that the gradient exists from early life onwards, where children from low socioeconomic backgrounds are more likely to be born with health problems or to develop them earlier than children from higher socioeconomic backgrounds. As the health stock depreciates over time for all individuals, the gradient will narrow over the lifecycle. Evidence in favour of this hypothesis is found in, for example, Kunst and Mackenbach (1994), Elo and Preston (1996), Deaton and Paxson (1998), Beckett (2000), Case and Deaton (2005), Herd (2006), and Kim and Durden (2007).

3. Data and Methods

3.1. Study population

The data used in the analysis are extracted from waves 2001 to 2011 of the Household Income and Labour Dynamics of Australia Survey (HILDA), waves 1999 and 2004 of the British Household Panel Survey (BHPS), and waves 2002, 2004, 2006, and 2008 of the German Socio-Economic Panel (SOEP). Each survey is part of nationally representative, longitudinal studies that began in 2001 (HILDA), 1991 (BHPS), and 1984 (SOEP), respectively. All three studies are set up as life panels, which sample the household as a unit, and members of each household are traced and interviewed annually from young adulthood onwards. Each year, a professional team of interviewers visits the same households to collect individual- and household-specific data, whereby the method of data collection is similar across the three studies. Each study achieved a reasonably high first wave cross-sectional and longitudinal response rate for the samples used in our analysis (Watson and Fry, 2001; Taylor et al., 2010; Wagner et al., 2006). The first-wave cross-sectional response rates were in HILDA 66%, in BHPS 74%, and in SOEP 65%, whereas the average longitudinal response rates were 92.6%, 93.5%, and 92.2% respectively. Response rates in the self-completion questionnaires were for the HILDA survey 91% and for the BHPS 94.5%.

Our working samples for each country are: (1) Australia: 82,805 (10,836) person-year (individual) observations, (2) Britain: 16,665 (11,733) person-year (individual) observations, and (3) Germany: 39,818 (16,149) person-year (individual) observations. We focus on individuals aged 20 and over.

3.2. Measures

To measure pain, we use the question on the extent of bodily pain experienced during the past four weeks that individuals were asked to fill out in a self-completion questionnaire for HILDA and BHPS alongside an interviewer-guided main questionnaire, and in the main questionnaire of SOEP. This question is one of two questions on pain taken from the SF-36 inventory, a multi-purpose, short-form health survey of 36 questions (Ware et al., 1993).

The questions on bodily pain differ slightly across the three surveys, but each asked for a ranking of experienced bodily pain in the past four weeks on a six category scale in the Australian and British data, and on a five-point scale in the German data. The exact wording of the pain question for Australia (HILDA) and Britain (BHPS) is: "How much bodily pain have you had during the past four weeks?". The possible responses are: No bodily pain, very mild, mild, moderate, severe, and very severe. The content and scaling for Germany is different, as the question refers to the duration of strong pain experienced in the past four weeks. The questionnaire in the SOEP is: "Please think about the last four weeks. How often did it occur within this period of time that you had strong physical pain?" The possible responses are: Never, almost never, sometimes, often, and always.

To compute averages of pain (strong pain for Germany), we imposed a linear scale ranging from 0 to 5 for Australia and Britain, and from 0 to 4 for Germany, although we need to caution that this arbitrary scale does not imply cardinality. To measure the prevalence of extreme levels of pain, we constructed a binary measure that takes the value of 1 if an individual experienced severe or very severe pain in Australia and Britain (pain > 3), and 0 otherwise. For Germany, this indicator takes the value 1 if an individual experiences always or frequently very strong bodily pain (pain ≥ 3), and 0 otherwise. Hence, from here onwards when we talk of the experience of extreme levels of pain we refer to "severe pain" in Australia and Britain, and "frequently strong pain" in Germany. While we are able to establish the extent of socioeconomic inequalities in pain within a country and their consistency across countries, we draw no conclusions on whether the population in one country experiences more pain than the population in another country given differences in the questions.

We consider in this analysis three traditional dimensions of socioeconomic status (SES): (1) Income; (2) Education; and (3) Occupation status. All three dimensions are considered, not only because they are the most common adulthood dimensions of SES analysed in health disparities research (See Shaver, 2007, and Krieger et al., 1997, for an overview), but also because of the competing hypotheses of why SES may be linked with health and pain (see Adler and Newman, 2002, for an overview of these hypotheses).

Our income measure is defined by income quartiles constructed from equivalised household disposable income which adjusts for the needs and the number of members of the household. The needs adjustment is based on the modified OECD scale which gives a weight of 1 for the first adult, 0.5 for subsequent adults (aged over 14) and 0.3 for each child

(Haagenars et al., 1994). This measure is an indicator for the immediate access to goods and services relevant to the moderation of pain. Its disadvantage is that it does not capture wealth.

The education measure is defined via highest educational achievement, where individuals are bundled within education groups (minimum, intermediate, degree, higher degree). This measure of SES has the advantage that education levels are fairly stable in adulthood, and it is less strongly affected by disease in adulthood than income and occupation. Among all three SES measures, education is the most likely to tell a story of pain-relevant lifestyles and behaviours, but, due to its fixed attribute, it is also reflective of childhood socioeconomic position.

Last, occupational class is defined as belonging to an occupation group based on the two-digit code of the International Standard Classification of Occupations (ISCO-88). This classification is used by the International Labour Organization (ILO) to define groups according to the tasks and duties undertaken (United Nations 2010). Occupation measures are the structural link between education and income; they are less volatile than income, and provide a measure of environmental and working conditions, and psychological demands of the job.

Descriptions of the coding of the main covariates are provided in Appendix A (Table A1). Summary statistics, which use sample weights that were provided in the public use files of each survey (Watson and Fry, 2001; Taylor et al., 2010; Wagner et al., 2006) of all variables used in the analysis are provided in Appendix B (Table B1).

3.3. Statistical methods

To estimate the differences in the odds of extreme levels of pain between the various socioeconomic groups, we apply a random effects logistic regression analysis which is commonly used when the dependent variable is a binary indicator (e.g. Collett, 2002; Agresti, 2002; Long and Freese, 2003). The latent, but true level of extreme pain ($Pain_{it}^*$) is a function of socioeconomic characteristics (X_{it}) and an individual-specific random effect (ν_i):

$$Pain_{it}^* = \alpha + X_{it}'\beta + \nu_i + \varepsilon_{it}\,. \qquad (1)$$

We do not observe the latent level of $Pain_{it}^{*}$, but a binary indicator P_{it} that takes the value 1 if the latent pain level is beyond a threshold (which we standardise to 0), and 0 otherwise. The error terms ε_{it} and v_i have a distribution of mean zero and constant variance ($\varepsilon_{it} \sim \varepsilon_{it}(0,\sigma_{\varepsilon}^{2})$, $v_i \sim v_i(0,\sigma_v^{2})$), and both ε_{it} and v_i are assumed to be independent of the regressors X_{it}'. Due to the longitudinal nature of our data, we observe individuals over time, and therefore we can exploit both the within-group and across-group variation of the data. The random effects specification allows for individual-specific, random variations of self-reports of bodily pain, and thus addresses some of the concerns about the potential for reporting heterogeneity.

Equation (1) is estimated separately for Australia, Britain, and Germany, and each model controls for income quartiles, education, and occupation, age-groups, gender, marital and foreigner status (X_{it}'). We follow the literature by calculating the odds ratios of extreme levels of pain and their 95% confidence intervals (CI) from the estimated coefficients obtained from a random effects logit model (Long and Freese, 2003). Our main interest is in the odds of reporting extreme levels of pain differentiated by socioeconomic groups (highest qualification, household income quartiles, occupation).

To construct pain-level profiles by SES over age-groups, we first estimate a linear random effects model similar to equation (1), and predict the unexplained, permanent part of pain levels that are purged of the influence of marital status, ethnicity, and SES (omitting one category of SES e.g. occupation when constructing the pain gradient by occupational groups). In a second step, we estimate a bivariate kernel regression model of the permanent component in pain on age for the socioeconomic group that was omitted from the first-step regression model. The estimated relationships between pain levels and age are then plotted graphically between the ages of 20 and 70. A similar procedure was used in Krueger and Stone (2008) to plot the pain-age profiles separately by gender. Kernel regression methods are flexible as they do not impose a functional form for the relationship between pain levels and age (Wand and Jones, 1995). For each country average pain levels are standardised to mean 0 and standard deviation of 1 in all samples to expresses differences in pain by age-groups in terms of sample standard deviations.

To separately identify age from cohort effects, we follow van Kippersluis et al. (2009) and Case and Paxson (1998) by constructing birth cohorts, and then profile for each cohort the evolution of the socioeconomic gradient in average pain by age. Again, the dependent variable is the residual obtained from a linear random effects model as outlined above. Similar as van Kippersluis et al. (2009), we construct birth-cohorts in five year intervals, starting for individuals born between 1940 and 1944 (average age of 59 in 2001 and 68 in 2011), and ending with individuals born between 1980 and 1984 (average age of 21 in 2001 and 30 in 2011). This classification yields nine cohort groups. Each of the nine cohorts can be followed over eleven years. The overlapping pain paths of these nine cohorts are estimated non-parametrically and graphed by socioeconomic groups: university versus minimum education, high versus low income, manual/elementary versus profession occupations.

The age effect is identified via the ageing over time within a cohort. The cohort effect is identified through comparison between consecutive cohorts at six overlapping ages across waves (See Table 1 for an illustration using three birth cohorts). The oldest cohort (1940-44) ages on average from 59 to 64 during the first four waves of the panel and can be compared with the second oldest cohort (1945-49) that covers this average age span over the last six waves. Likewise, the second and third oldest (1950-54) cohorts overlap with ages 54 to 59 during the first and last four waves.

We apply this ageing-cohort analysis to our Australian dataset only, for which we have 11 waves available. Building lifecycle profiles of the SES gradient of pain by overlaying the ageing profiles of consecutive cohorts requires the availability of large T dimension of the panel dataset. The appropriate size of T is debatable, but we suggest that more than the two and four time periods, which we have available for the British and the German dataset, respectively, are required.

4. Socioeconomic gradients in pain

4.1. Societal distributions

In Australia, 68.4% (95% CI 67.6 to 69.1) of all men and 69.5% (95% CI 68.7 to 70.3) of all women reported some level of pain, while in Britain 44.8% of men (95% CI 43.6 to 45.9) and 51.2% of women (95% CI 50.0 to 52.4) reported pain. In Germany, 55.3% of men (95% CI 54.5 to 56.2) and 60.0% of women (95% CI 59.0 to 60.9) reported pain at any frequency. In Australia a smaller proportion of men and women report severe pain, 4.0% of men (95% CI 3.7 to 4.3) and 4.7% of women (95% CI 4.4 to 5.0), than in Britain (5.4% of men (95% CI 4.9 to 5.9), 7.5% of women (95% CI 7.0 to 8.1). Germany had the highest proportion of individuals reporting frequently strong pain, 6.9% of men (95% CI 6.5 to 7.3) and 9.5% of women (95% CI 8.9 to 10.1), however this figure is not directly comparable to Australia and Britain due to a different wording and scaling of the pain question. After conditioning on age, education, equivalised household income, occupation, marital status, and foreigner status, the large differences between men and women remain. The estimated odds of extreme levels of pain are 1.4 times higher for women in Australia (95% CI 1.2 to 1.6), 1.6 times in Britain (95% CI 1.3 to 1.8), and 1.8 times in Germany (95% CI 1.6 to 2.1).

Differences in mean levels of pain (strong pain for Germany) significantly widen as individuals age. Figures 1a-1c plot average pain levels by men and women (kernel regression).[1] At all ages, women report significantly greater levels of pain than men in Britain and of strong pain in Germany. In all three countries, at age 60 women report about 0.2 SD (Australia, Germany) to 0.3 SD (Britain) greater levels of pain. Gender differences in bodily pain emerge in Britain from age 20 onwards, in Australia from age 40 onwards, and in Germany they are equally present in all age groups. Gender-pain differences remain large after age 60 in all three countries.

4.2. Socioeconomic inequalities in bodily pain

In Table 2 we report the odds ratios for groups separated by income quartiles (base: highest quartile), educational qualification (base: higher degree), and occupation (base: professional occupation) obtained from a random effects logistic regression. For illustration, we also list the prevalence of experiencing severe levels of pain for each group and the number of observations for which extreme levels of pain are observed. Full estimation results of the random effects logit models are reported in Table B2 in Appendix B.

In Australia and Britain, individuals with minimum schooling (or drop-out) have a 2.1 (95% CI 1.8 to 2.6) and 2 (95% CI 1.4-2.7), respectively, greater odds of experiencing severe pain than individuals with a higher (university) degree. In Germany, the odds of experiencing frequently strong pain are 2.5 times greater (95% CI 1.9 to 3.4) for individuals with minimum schooling than for individuals with a higher degree. In Australia, Britain, and Germany the odds of severe pain are 2.1 times (95% CI 1.8 to 2.4), 1.8 times (95% CI 1.4 to 2.3), and 1.7 times (95% CI 1.4 to 2.0), respectively, greater for individuals in the lowest than for individuals in the highest income quartiles.

Across all three countries there are important differences in the odds of experiencing extreme levels of pain across occupations. Differences occur mainly between white- and blue collar professions. The odds of extreme levels of pain for machine operators and elementary

[1] Whether males and females have different pain thresholds is still open to debate. In their recent review Racine et al. (2012) conclude that 10 years of laboratory research have not been successful in producing a clear and consistent pattern of sex differences in human pain sensitivity.

workers, which capture individuals with low levels of skills and high levels of exposure to physical strain in their job, are at least twice as large as for individuals working in a professional occupation (teachers, academics, lawyers). For instance, in Australia and Britain, the odds of machine operators to report extreme levels of pain relative to the odds of professionals is 2.3 (95% CI 1.8 to 3.0) and 2.2 (95% CI 1.3 to 3.0), respectively, whereas in Germany it is 2.7 (95% CI 2.0 to 3.6). Similar odds ratios and 95% CIs were found for elementary workers. Managers and technicians do not differ, or differ only marginally, in their odds of reporting extreme levels of pain from the odds experienced by professionals in any of the three countries.

It should be noted that these estimates are based on simultaneously controlling for income, education, and occupational status, and thus, because of the interdependencies of the three categories, should reflect lower-bound estimates. In a robustness check (provided upon request), we added each SES component individually. Ignoring the inter-dependence of income, education, and occupational status, the odds ratios increase by 1/3 to 2/3 for the lower SES classes such as minimum schooling, lowest income group or machine operators.

5. Socioeconomic inequalities of pain over the lifecycle

5.1. Age-related socioeconomic inequalities in bodily pain

Figures 2a-2c plot the estimated average pain levels (kernel regression) reported by individuals between the ages of 20 and 70 stratified by four education groups (Higher degree, Degree or equivalent, Intermediate education, Minimum). Consistently across all three countries and ages, individuals with a higher degree report the lowest levels of pain. The gap between the two extreme ends of the education spectrum (Minimum versus Higher degree) widens from approximately age 40 onwards, dramatically so in Germany. In all three countries, the gaps between the lowest and highest education groups are largest around age 60, where average levels of pain are approximately 0.3 SD larger for the minimum schooling group in Australia and 0.5 SD in Germany relative to the highest education group. Smaller differences are observed for Britain (0.2 SD at ages 55). In Australia and Germany, and to some extent in Britain, the pain-profiles between Higher degree and Minimum schooling continue to diverge after age 60 (65 in Germany). In none of the three countries do we find any evidence of convergence of the pain profiles between lowest and highest education groups.

Figures 3a-3c compare the estimated pain profiles for individuals between the ages of 20 and 70 stratified by income groups (1^{st} (lowest) to 4^{th} (highest) quartile). The trends in the income gradient of bodily pain are similar between Australia and Britain, where the gap between the highest and the lowest income quartiles widens dramatically from age 35 onwards. Average pain levels rise steeply for the lowest income groups of approximately 50% between ages 35 and 60 in both Australia and Britain, while in Germany a steep rise in pain levels occurs later for the lowest income group (age 45 onwards). At age 55, the difference in average pain levels between the lowest and the highest income groups makes up 0.4 SD in Australia and Germany, and 0.2 SD in Britain. Although some convergence exists for all three countries after the age of 60, differences in pain between the first and fourth income quartile group remain large until age 70.

Figure 4a-4c compare the estimated pain profiles for individuals between the ages of 20 and 70 stratified by three occupational groups (Professionals, Service/clerks, and Manual/elementary workers). There are no differences in levels of pain at younger ages of around 30 in Australia and Germany, and of 25 in Britain. Thereafter, a substantial gap emerges especially between professionals and elementary/manual workers in Australia and Germany that peaks around age 60. Pain profiles drop for all occupational groups in Australia and Germany after age 60, but there is no evidence of convergence. A slightly different pattern occurs for Britain, where the maximum gap between professionals and manual/elementary workers occurs around age 47, temporarily converge at age 65, and then widen again dramatically afterwards. For none of the countries do we observe a convergence of the pain profiles across occupations at older ages.

We have also conducted a sensitivity check with respect to omitting from the regression model all other socioeconomic indicators. In this restricted model, the SES gradients in pain levels over age are even more pronounced (results provided upon request).

5.2. Age-related socioeconomic inequalities in bodily pain controlling for cohort effects

Using the Australian data for which we observe eleven consecutive years of data, Figure 5 reports the age-pain profiles by cohort and socioeconomic status (minimum versus university education; first versus fourth income quartiles; manual/elementary versus professional occupations). All figures in the left panels graph the sum of age-pain profiles for each cohort followed over eleven years (non-parametric estimates). The profiles depicted in a long-dashed line refer to the pain-age profiles of the low SES groups, while the profiles depicted in a short-dashed line refer to the pain-profiles of the high SES groups. Except for the extreme ends of the age distribution, the pain profiles at each year of age overlap for two, in some cases even for four cohorts. It is these overlapping data that we are exploiting to identify the lifecycle profiles in pain.

All figures in the right panels graph the difference in pain levels at each age between the low and high socioeconomic groups (solid line). For each age, the pain data used to construct this difference stems from an average that is taken across the number of cohorts for whom data are available at this age (actual not estimated values). In addition, we included in this graph the average difference in pain between low and high SES groups for each birth cohort (averaged over all ages which the birth cohort covers). This graph is a summary indicator of the trend of the differences in pain by cohorts, irrespective of age (solid line with bullet points).

Figure 5a compares the age-pain profiles between the two extreme ends of the education ladder. In almost all cases, the age-pain profiles of individuals with minimum schooling lie above the age-pain profiles of individuals with higher education (university degree). The exceptions are for cohorts that are roughly between 30 and 40 years of age. An important observation is that for the oldest cohort born between 1940 and 1944, the age-pain profiles differ substantially in both their levels and shapes between minimum and higher education groups. Where for the former the age pain profile is convex, it is concave for the latter. For instance, for individuals with minimum education pain is decreasing between ages 55 and 60, but then it steeply increases from thereafter (probably after retirement). For individuals with a university degree pain increases up until age 65 (retirement), but then steadily decreases afterwards.

Figure 5b shows the pain difference between these two education groups for all ages (averaged over cohorts which cover the same years of age). First to note is that the average difference is always positive (except for at age 37, 46, and 67). The difference is large of about 0.2 to 0.3 sample standard deviations between ages 22 to 30, then the difference drops down to zero between ages 35 to 40, and then consistently increases to almost 1 SD when approaching age 70. Looking only at the age-averaged pain differences between the two groups across cohorts, one sees a steep increase in the pain differences for the two oldest cohorts (differences of up to 0.3 SD).

Figures 5c compares the age-pain profiles by each cohort between individuals in the lowest income and highest income quartiles. Similar as for the pain differences between education groups one observes that the age-pain profiles are always higher for the low income groups relative to the high income groups, with small exceptions for age groups 30 to 40. Again, the age-pain profiles of low income groups of the oldest two cohorts are substantially different from the two oldest cohorts from the highest income groups. The profiles for the former are convex, whereas they are concave for the latter two. Figure 5d makes clear that the average difference in pain over the life course increases steadily from age 40 onwards, it reaches its peak just before retirement age with a difference of about 0.5 SD, drops, and then soars to almost 1 SD at age 70. There are inconsistent cohort differences in the income gradient of pain for the younger cohorts, but dramatic and increasing differences for the older cohorts.

Figures 5e compares the age pain-profiles by cohorts between manual/elementary workers and individuals in professional occupations. The trend in the differences of the two groups over the life course is similar to the trends between education groups: Age-pain profiles of the youngest manual or elementary workers lie almost always above the age-pain profiles of the youngest professionals. There are no obvious level differences between the ages 30 to 40. Age-pain profiles differ substantially for the oldest cohort. Again, the age-pain profiles are convex for the oldest cohort of manual workers, while they are concave for the oldest cohort of professionals.

Figure 5f depicts the difference in pain for each age group between the two occupational extremes. There is a clear downward trend in pain differences from the younger ages, with a maximum difference of 0.3 SD, that drops down to negative around the ages of 30 and 40, and then increases steadily up to 0.5 SD difference at the oldest age.

Consistent with our age-pain analysis that does not control for the cohort effects, we can again find no evidence in the data that age-pain profiles fully converge in older ages, independent of how we measure socioeconomic status.[2]

6. Discussion

Chronic pain is a common experience, and its burden on individuals, families and the economy as a whole is substantial. In this paper we contribute to the existing literature by focusing on the extent of SES inequalities in bodily pain using three large nationally-representative longitudinal surveys from Australia, Britain and Germany. A particular focus of the paper has been on establishing how SES inequalities in pain change over the life course.

[2] Note, for each comparison in Figures 5b, 5d, and 5f we find one outlier observation at age 67, where the pain difference between the two SES groups drops once to highly negative. We cannot explain this outlier observation, but suggest that it should be treated as the exception to the rule.

Our analysis has a number of strengths and limitations. The main strength is the use of large, nationally-representative longitudinal surveys that enable an analysis of the socioeconomic inequalities in pain by age groups, and also allow for the random-effects modelling of individual heterogeneity. Another advantage is that all three surveys have similarly measured control variables available which facilitates our cross-country comparison in pain risk factors (see Frick et al., 2007). Importantly, due to the longitudinal nature of the three data sources, we have been able to explicitly model individual-specific random variations in the self-report of pain. Another advantage is that, at least for Australia, we have been able to control for cohort effects when comparing the age-pain profiles between SES groups.

The main limitation of this study is that we cannot account for the possibility of reverse causality, or of unobserved confounders, with pain potentially leading to lower income, to less investment in education, or selection into certain occupations, or early retirement and therefore reduction in income, rather than these characteristics directly leading to pain (Stewart et al., 2003). Chronic back pain, for instance has been shown to dramatically drive early retirement decisions of Australians, and a subsequent depletion to their retirement savings (Schofield et al., 2012). Therefore we are unable to make causal statements, such as giving higher income to those in low socioeconomic groups through higher welfare transfers would lead to less pain by, for example, better access to health care or medicine.

Another limitation of this paper is that the use of self-reported pain data relies on the assumption that individuals within a country interpret the pain question and the response scale in the same way. Failure of this assumption would create a measurement problem and if this heterogeneity in reporting pain is systematically linked to socioeconomic characteristics then estimates of the socioeconomic gradients in pain could be could biased. The literature on anchoring vignettes acknowledges and offers a solution to this problem by rescaling the self-assessments of an individual by using the answers to a set of vignettes reflecting hypothetical situations (See Chevalier and Fielding, 2011, for an overview of the literature). Using such anchoring vignettes, Bago d'Uva et al. (2008a, 2008b) find that the better-off, in terms of income and education, are often observed to rate their pain and that of others significantly higher, which is interpreted in the literature as higher aspirations for one's own health. Thus, if the better-educated and higher-income individuals tend to over-report pain, then the aforementioned socioeconomic inequalities in pain will likely be an under-estimate of the true relationship.

Further, we are unable to control for recall bias in bodily pain which is evaluated by survey respondents over a period of four weeks, given the possibility that memory processes affect how retrospective pain is reported (Gorin and Stone, 2001). For instance, individuals with higher versus lower variability of real-time pain will recall pain at higher levels (Stone et al., 2005). However, this may be less of a problem in our context, as the results are intended to serve as a population benchmark of the overall distribution of pain rather than as a basis for clinical decision-making. Also, the possibility that patients report differing levels of pain, depending on the status of the individual gathering the pain rating (Williams et al., 2007), is not so relevant in our context where pain data is collected with a self-completion questionnaire filled out by the interviewee in the absence of the interviewer. Our measure also does not capture any notion of pain-related disability for which strong SES gradients have been reported and it does not capture the possibility that pain is the cause or consequence of other co-morbidities such as anxiety and depression (Dominick et al., 2012).

Through our analysis, however, we have found a remarkable consistency in the SES gradients in pain by educational qualification, household income and occupational group, and also in the age profiles of pain by SES, across the populations of Australia, Britain and Germany. The evidence suggests large SES differentials in the distribution of pain, especially when assessed at older ages. Importantly, we can find no evidence that pain profiles converge after retirement age. The reported large differences are all the more evident given that each of these countries has had universal national health care systems in place for many decades, which should ensure equitable access to health care.

Our findings of strong socioeconomic inequalities in bodily pain, as measured by education, household income and occupational class, confirm the results of previous studies mostly based on smaller and often restricted age samples (Saastomoinen et al., 2005; Lahelma, 2005; and Mottram et al., 2008), or that stem from smaller countries such as Denmark (Eriksen et al., 2003, 2006; Sjøgren et al., 2009). In line with the results from Danish data on the prevalence of chronic pain (Eriksen et al., 2006; Sjøgren et al., 2009), in all three countries individuals with minimal education or working in occupations of high levels of physical strain, are most likely to experience extreme levels of pain. Our findings that manual workers report the highest whereas professionals report the lowest levels of bodily pain are consistent with Finish data on chronic pain (Saastomoinen et al., 2005).

Where we build upon these studies is that we have shown that SES gradients in pain widen substantially by age-groups, roughly equally in all three countries. This pattern is not solely driven by cohort differences in the socioeconomic gradient of pain as shown by our

Australian data. Similar patterns of a rapid decline in general health in older ages were reported in Van Kippersluis et al. (2009). Similar as other studies on the socioeconomic disparities in health, we find that the socioeconomic gradient in pain exists already at early ages, but only for education and occupation differences. These socioeconomic disparities in pain become magnified over the lifecycle similar as suggested for health in Ross and Wu (1996), Lynch (2003), Wilson et al. (2007), Kim and Durden (2007). One possibility for this phenomenon is that individuals working in e.g. manual or elementary occupations are more likely to experience a series of accidents or other health shocks that, even with treatment, cause a heterogeneous aging process (see Deaton and Paxson, 1998). The growing gap in pain over the lifecycle may also be the result of a compositional change in the low and high SES samples due to systematic, pain-related drop outs. A growing gap would result if the high SES individuals with high levels of pain are more likely than the low SES individuals with high levels of pain to drop out of the sample with increasing age. Such a hypothesis cannot be tested because we do not know the pain levels of the individuals at their time of the attrition. However, it seems more reasonable to assume that the low SES groups in high levels of pain drop out of the sample (e.g. die earlier), since this group is less able to buffer severe health shocks. As a consequence, if at all, the socioeconomic gradient in pain at older ages should be larger than the estimates presented. In addition, studies which investigated this question in detail conclude that the estimated effects of the socioeconomic gradients in health do not change significantly when controlling for systematic attrition (e.g. Jones et al., 2006).

Our finding that the pain-gender gap emerges already early in adulthood is in line with the numbers reported on chronic pain in Sjøgren et al. (2009), Riley et al. (1998), and Unruh (1996), but contradicts the lower average acute pain ratings for women relative to men until age 45 in the US reported by Krueger and Stone (2008).

In order to reduce the costs of pain, Phillips and Harper (2011) suggest that, "healthcare decision-makers need to adopt a broad, strategic and coherent perspective in determining issues relating to service provision and resource allocation". It is hoped that the findings of this paper will be of value in this context by clearly documenting the extent of SES inequalities in pain using robust techniques, showing how SES inequalities in pain consistently widen with age, and documenting the remarkable similarity of the results across three countries.

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Table 1: Illustration of average age by cohort in each wave for three selected cohorts

	WAVES																				
											1	2	3	4	5	6	7	8	9	10	11
Cohort						1	2	3	4	5	6	7	8	9	10	11					
	1	2	3	4	5	6	7	8	9	10	11										
1940-44											58	60	61	62	63	64	65	66	67	68	69
1945-49						54	55	56	57	58	59	60	61	62	63	64					
1950-54	49	50	51	52	53	54	55	56	57	58	59										

Notes: Each of the nine cohorts is defined over a 5-year window, where birth cohorts start in 1940-1944, up until 1980-1984. As the interview is not always conducted at the exact same date, there are on average six age groups in each cohort and in each year. Average age is rounded to the nearest age integer.

Table 2: Prevalence[a] and odds ratios[b] of reporting severe pain (Australia, Britain) and frequently strong pain (Germany) by socioeconomic status

Dependent variable	Australia Reporting (very) severe pain				Britain Reporting (very) severe pain				Germany Reporting always or freq. strong pain			
	Prev	**Number obs /total**	**Odds Ratio**	**95% CI**	**Prev**	**Number obs/total**	**Odds Ratio**	**95% CI**	**Prev**	**Number obs/total**	**Odds Ratio**	**95% CI**
University degree	2.7	620/22834	1.00		3.6	112/3121	1.00		4.4	316/7111	1.00	
Degree or equivalent	4.3	1166/26896	1.46	1.21-1.76	5.4	248/4618	1.33	0.96-1.70	8.3	789/9562	1.89	1.47-2.44
Intermediate education	3.7	497/13580	1.38	1.11-1.71	6.0	378/6323	1.28	0.93-1.64	8.4	1593/18977	1.85	1.45-2.36
Minimum education	6.8	1318/19495	2.14	1.75-2.62	13.0	339/2603	2.04	1.39-2.69	12.7	527/4157	2.53	1.88-3.40
4th income quartile	2.9	609/20701	1.00		3.8	159/4166	1.00		5.8	573/9951	1.00	
3rd income quartile	3.5	720/20701	1.23	1.07-1.42	5.1	214/4166	1.25	0.95-1.55	7.8	682/8692	1.42	1.20-1.69
2nd income quartile	4.0	830/20701	1.39	1.20-1.61	6.0	249/4164	1.28	0.97-1.58	8.5	950/11205	1.45	1.22-1.72
1st income quartile (lowest)	7.0	1442/20702	2.05	1.77-2.37	10.9	455/4169	1.81	1.36-2.25	10.2	1020/9959	1.67	1.38-2.00
Professional occupation	2.8	496/17588	1.00		3.2	68/2117	1.00		4.7	387/8188	1.00	
Legislators	3.4	325/9593	1.16	0.95-1.43	5.6	141/2539	1.59	1.04-2.14	6.1	167/2739	1.23	0.92-1.66
Technicians	4.0	511/12799	1.23	1.01-1.48	5.5	120/2166	1.57	1.01-2.12	7.6	685/9031	1.29	1.03-1.62
Clerks	4.6	514/11237	1.31	1.07-1.61	5.7	149/2592	1.28	0.82-1.75	8.0	362/4511	1.28	0.98-1.67
Service workers	4.7	458/9743	1.38	1.12-1.70	7.7	205/2660	1.47	0.95-2.00	9.5	380/3993	1.67	1.27-2.19
Skilled agricultural worker	5.3	138/2598	1.28	0.93-1.76	7.9	15/190	2.06	0.63-3.49	11.8	56/475	2.59	1.51-4.42
Trade and craftsmen	4.5	330/7412	1.74	1.36-2.21	6.5	111/1717	1.84	1.12-2.55	8.9	476/5328	2.17	1.66-2.82
Machine operator	6.9	354/5144	2.33	1.83-2.98	9.0	122/1359	2.16	1.31-3.00	11.8	331/2808	2.69	2.01-3.59
Elementary occupation	7.1	475/6691	1.89	1.52-2.35	11.0	146/1325	1.95	1.20-2.71	13.9	381/2734	2.52	1.90-3.35
Individuals		10836					11733				16145	
Person-year observations		82805					16665				39807	
Average/Max T		4/11					1.4/2				2.5/4	
Intra-individual correlation		0.576					0.328				0.586	

Notes: Prevalence (Prev): percentage of individuals in the sample that report severe levels of/frequently strong pain; Odds ratios are obtained from a random effects logistic regression. All models control for gender, age dummy variables, foreigner status, and marital status. Net monthly household income is adjusted by household size (children aged 0 to 14 receive the weight of 0.3, all adults other than the household head receive a weight of 0.5, the head of the household receives a weight of 1).

Figure 1: Level of pain (Australia, Britain) and strong pain (Germany) by gender

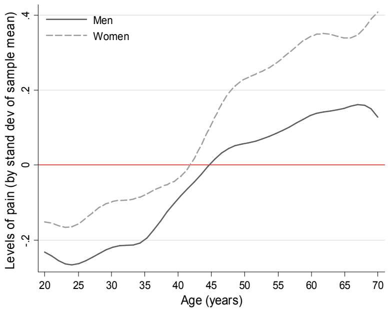

Figure 1a: Australia

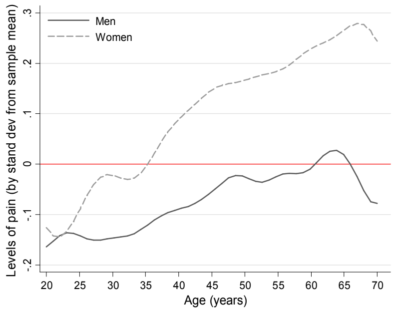

Figure 1b: Britain

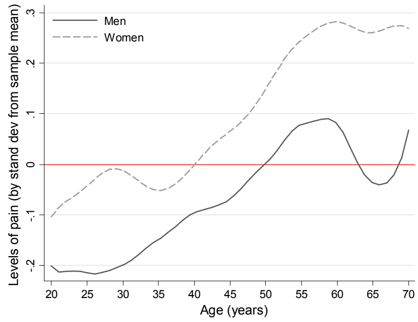

Figure 1c: Germany

Notes: Figures result from kernel regression of pain on age while controlling for equivalised household income, education, occupation, marital status and foreigner status and individual-specific random effects (bandwidth=2). Levels of pain are standardised to mean 0 and standard deviation of 1.

Figure 2: Level of pain (Australia, Britain) and strong pain (Germany) by education groups

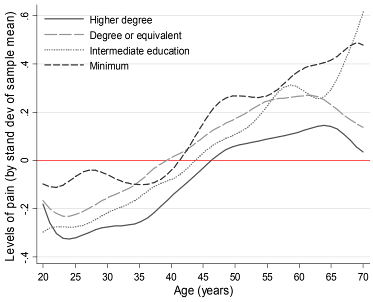

Figure 2a: Australia

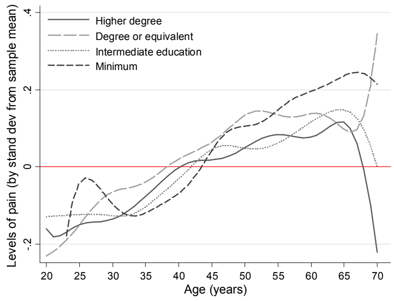

Figure 2b: Britain

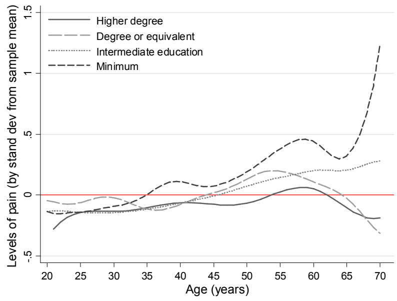

Figure 2c: Germany

Notes: Figures result from kernel regression of pain on age while controlling for equivalised household income, occupation, marital status and foreigner status and individual-specific random effects (bandwidth=2). Levels of pain are standardised to mean 0 and standard deviation of 1.

Figure 3: Level of pain (Australia, Britain) and strong pain (Germany) by household income

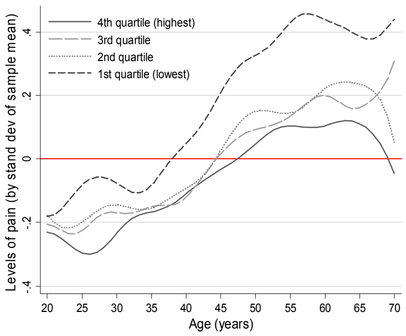

Figure 3a: Australia

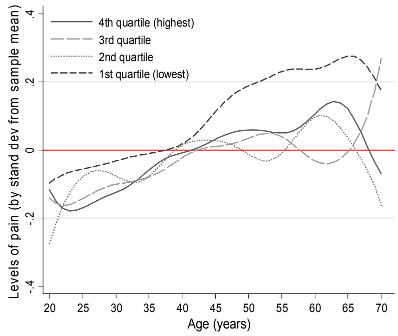

Figure 3b: Britain

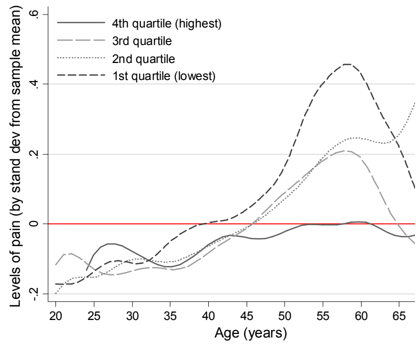

Figure 3c: Germany

Notes: Figures result from kernel regression of pain on age while controlling for education, occupation, marital status and foreigner status and individual-specific random effects (bandwidth=2). Levels of pain are standardised to mean 0 and standard deviation of 1.

Figure 4: Level of pain (Australia, Britain) and strong pain (Germany) by occupation

Figure 4a: Australia

Figure 4b: Britain

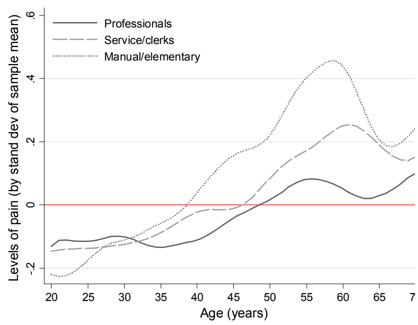

Figure 4c: Germany

Notes: Figures result from kernel regression of pain on age while controlling for equivalised household income, education, marital status and foreigner status and individual-specific random effects (bandwidth=2). Levels of pain are standardised to mean 0 and standard deviation of 1.

Figure 5: Age-cohort profiles of the socioeconomic gradient of pain for Australia (HILDA)

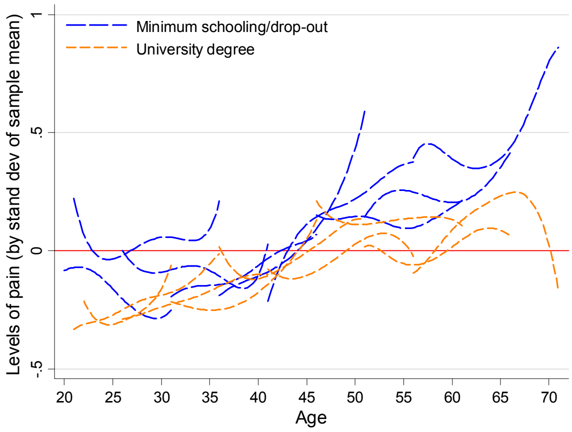

Figure 5a: Age-cohort profiles by high and low levels of education (non-parametric estimates)

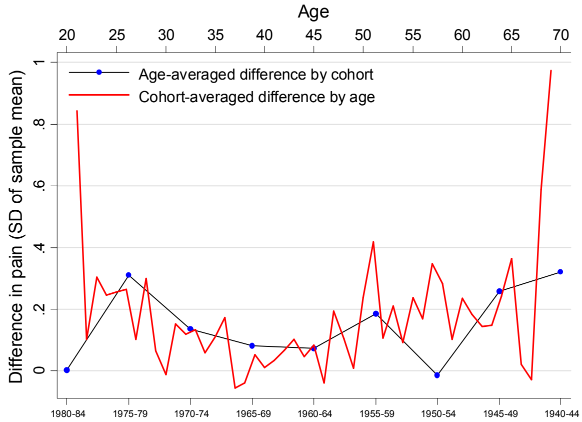

Figure 5b: Differences in pain between low and high education groups (actual values)

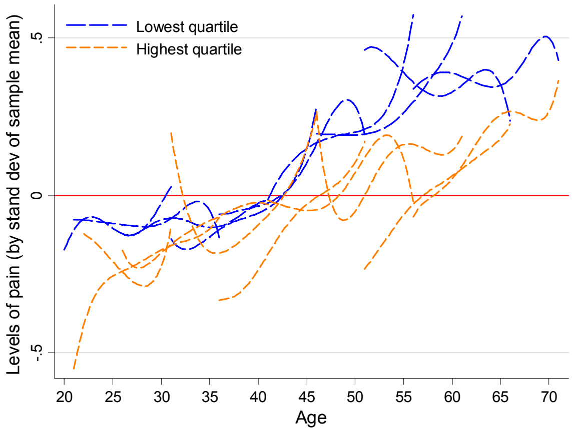

Figure 5c: Age-cohort profiles by high and low levels of income (non-parametric estimates)

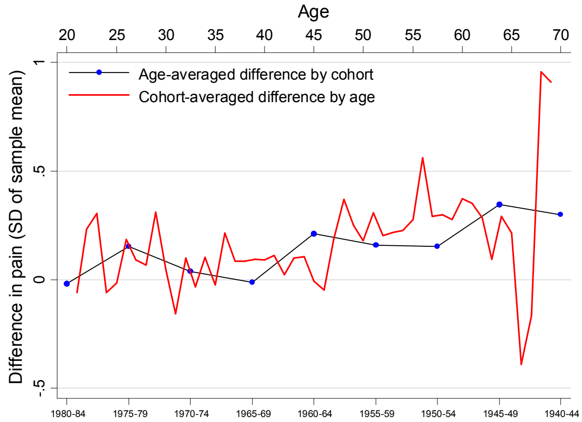

Figure 5d: Differences in average pain between high and low income groups (actual values)

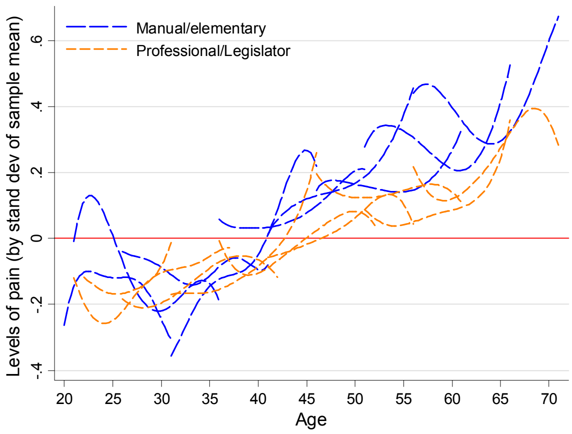

Figure 5e: Age-cohort profiles by professional and manual occupational groups (non-parametric estimates)

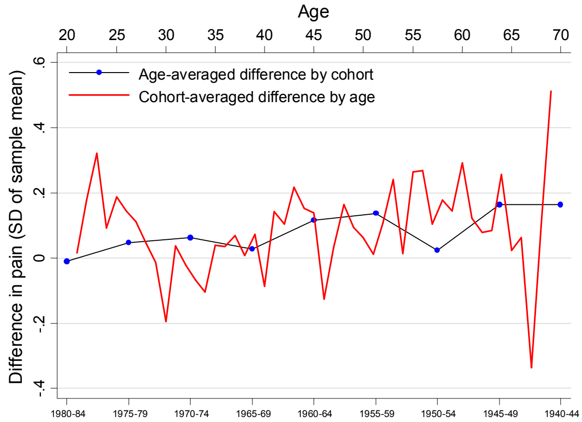

Figure 5f: Differences in average pain between occupational groups (actual values)

APPENDIX A

Table A1: Variable definitions

Variable name	*Question in Questionnaire*
Schooling	
Minimum:	(1) Australia: Year 11 (complete compulsory education) or less; (2) Britain: No qualifications; (3) Germany: school drop-out and/or no vocational training.
Intermediate:	(1) Australia: Year 12 or certificate I/II); (2) Britain: GCE levels (a, o), commercial qualification, CSE grade 2-5, scot grade 4-5, other qualification; (3) Germany: Apprenticeship or other equivalent training.
Degree:	(1) Australia: Certificate III/IV (Advanced training above Year 12) or Diploma; (2) Britain: teaching qualification, other higher qualification, nursing qualification; (3) Germany: Nursing, teaching, or civil service qualification
Higher degree:	(1) Australia: Postgraduate degree, graduate diploma, bachelor degree, diploma degree; (2) Britain: Postgraduate degree, bachelor degree; (3) Germany: University or technical university degree.
Occupation (ISCO-88)	HILDA: What kind of work do you do in this job? That is, what is your occupation called and what are the main tasks and duties you undertake in this job? Please describe fully. BHPS: What was your (main) job last week? Please tell me the exact job title and describe fully the sort of work you do. SOEP: What is your current position/occupation? *Please give the exact title.*
Household income	HILDA: Household financial year disposable income individual estimate ($) (Recalculated into monthly figure by authors). BHPS: Household income in month before the interview (£) SOEP: If you take a look at the total income from all members of the household: how high is the monthly household income today? (Euro)
Equivalence scales	Equivalence scales are constructed as follows: ES = 0.3 × (Number of children ages 0-14) + 0.5 × {(Number of adults age > 14) – 1} + 1 × Head of household. Equivalised household income = Household income/Equivalence Scale

APPENDIX B

Table B1: Descriptive statistics of variables used in logistic and kernel regression

	Australia			Britain			Germany		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Average level of pain	1.227	0	5	1.008	0	5	0.979	0	4
Proportion extreme pain	0.042	0	1	0.046	0	1	0.092	0	1
Proportion of pain > 0	0.684	0	1	0.488	0	1	0.589	0	1
Female	0.469	0	1	0.478	0	1	0.454	0	1
Foreigner status	0.252	0	1	0.022	0	1	0.083	0	1
Being married	0.685	0	1	0.591	0	1	0.580	0	1
Age 20 to 25	0.129	0	1	0.113	0	1	0.062	0	1
Age 26 to 30	0.111	0	1	0.110	0	1	0.090	0	1
Age 31 to 35	0.118	0	1	0.125	0	1	0.118	0	1
Age 36 to 40	0.122	0	1	0.145	0	1	0.153	0	1
Age 41 to 45	0.128	0	1	0.135	0	1	0.167	0	1
Age 46 to 50	0.121	0	1	0.118	0	1	0.149	0	1
Age 51 to 55	0.107	0	1	0.116	0	1	0.122	0	1
Age 56 to 60	0.080	0	1	0.084	0	1	0.086	0	1
Age 61 to 65	0.043	0	1	0.035	0	1	0.038	0	1
Age 66 to 70	0.019	0	1	0.012	0	1	0.009	0	1
Age 71 to 75	0.011	0	1	0.005	0	1	0.003	0	1
Age > 75	0.011	0	1	0.002	0	1	0.001	0	1
Higher degree	0.275	0	1	0.200	0	1	0.136	0	1
Degree or equivalent	0.322	0	1	0.317	0	1	0.238	0	1
Intermediate education	0.173	0	1	0.371	0	1	0.509	0	1
Minimum	0.231	0	1	0.111	0	1	0.117	0	1
Income[1] 1st quartile	18,809	17	26,501	741	192	1,012	1,064	7	1,406
Income 2nd quartile	32,102	26,501	37,571	1,281	1,012	1,527	1,715	1,407	2,000
Income 3rd quartile	44,336	37,573	52,257	1,833	1,529	2,187	2,394	2,001	2,825
Income 4th quartile	75,219	52,259	525,146	3,236	2,188	4,1671	4,094	2,826	40,000
Managers	0.115	0	1	0.167	0	1	0.057	0	1
Professionals	0.208	0	1	0.137	0	1	0.165	0	1
Technicians	0.154	0	1	0.139	0	1	0.227	0	1
Clerks	0.140	0	1	0.161	0	1	0.117	0	1
Service and sales	0.118	0	1	0.146	0	1	0.109	0	1
Skilled agricultural	0.026	0	1	0.011	0	1	0.013	0	1
Craft and trade	0.091	0	1	0.105	0	1	0.147	0	1
Machine operator	0.065	0	1	0.072	0	1	0.082	0	1
Elementary	0.083	0	1	0.062	0	1	0.084	0	1

Notes: Summary statistics apply sample weights for each country and is conducted on estimation samples used in the logistic regression analysis. [1]Equivalised household income is denoted in Australia in AUS$, in Britain in £, and in Germany in €. Household income is adjusted by an equivalence scale which is the sum of all household members, where each household member is attached a weighting factor according to age (needs).

Table B2: Full estimation results (Coefficient estimates): Probability of reporting severe pain (Australia, Britain) and frequently strong pain (Germany)

	Australia		**Britain**		**Germany**	
	Coef	SE	Coef	SE	Coef	SE
Female	0.320	0.067	0.444	0.087	0.593	0.074
Non Australian origin	-0.027	0.074	0.571	0.085	0.322	0.122
Married or de facto	-0.136	0.060	-0.129	0.081	-0.007	0.072
Base: Age 41 to 45						
Age 20 to 25	-0.700	0.115	-0.565	0.175	-0.869	0.160
Age 26 to 30	-0.291	0.111	-0.182	0.159	-0.763	0.138
Age 31 to 35	-0.107	0.101	-0.114	0.149	-0.449	0.114
Age 36 to 40	-0.123	0.090	-0.024	0.143	-0.262	0.094
Age 46 to 50	0.267	0.086	0.016	0.151	0.283	0.088
Age 51 to 55	0.625	0.095	0.096	0.156	0.591	0.098
Age 56 to 60	0.705	0.104	0.015	0.168	0.875	0.108
Age 61 to 65	0.636	0.121	0.101	0.198	0.704	0.145
Age 66 to 70	0.687	0.152	0.102	0.229	0.279	0.306
Age 71 to 75	0.676	0.176	0.320	0.242	1.095	0.467
Age 76 and above	1.296	0.162	0.813	0.228	0.444	0.901
Base: University degree						
Degree or equivalent	0.379	0.096	0.285	0.142	0.638	0.129
Intermed education	0.321	0.110	0.250	0.142	0.615	0.124
Minimum	0.762	0.102	0.713	0.163	0.927	0.151
Base: 4th quartile						
Income 3rd quartile	0.209	0.071	0.224	0.121	0.354	0.089
Income 2nd quartile	0.329	0.074	0.245	0.122	0.370	0.089
Income 1st quartile	0.716	0.075	0.592	0.125	0.510	0.095
Base: Professionals						
Legislators	0.152	0.105	0.465	0.177	0.210	0.150
Technicians	0.203	0.097	0.449	0.182	0.255	0.116
Clerks	0.273	0.103	0.250	0.183	0.249	0.135
Service workers	0.324	0.107	0.386	0.182	0.512	0.138
Skilled agri workers	0.245	0.164	0.723	0.354	0.950	0.274
Trade and craftsmen	0.552	0.123	0.608	0.198	0.773	0.135
Machine operators	0.847	0.125	0.768	0.200	0.988	0.149
Element occupations	0.635	0.111	0.669	0.197	0.926	0.145
Constant	-5.825	0.146	-4.670	0.263	-5.625	0.167
Person-year observ.	82805		16665		39807	
Rho	0.576		0.328		0.586	

Note: Reported standard errors (SE) are clustered by individual-specific identifiers to control for the pooled nature of the data.